

UNIVERSITY OF CALIFORNIA
COLLEGE OF AGRICULTURE
AGRICULTURAL EXPERIMENT STATION

CIRCULAR No. 240

MAY, 1922

**HARVESTING AND HANDLING CALIFORNIA PEARS
FOR EASTERN SHIPMENT**

BY WILLIS P. DURUZ



Attractive and honest packing pays well.

California is confronted with the problem of marketing a rapidly increasing production of pears. In 1920, California pear orchards contained 2,305,646 trees of bearing age and 2,178,526 trees of non-bearing age,¹ which indicates that the producing area may soon be doubled. In order to get the full benefit of growing good pears, it is essential to use the most efficient, rapid, and economical methods of harvesting, packing, and shipping California pears, particularly for Eastern shipment.

During the season of 1921, the Division of Pomology conducted a survey of the chief pear-shipping districts of the state to obtain from successful pear growers and shippers² information relative to the best

¹ Fourteenth Census of the U. S., 1920, Bulletin of California: Agriculture.

² The writer is indebted to the following persons and organizations for certain information and data contained in this circular; Mr. and Mrs. A. G. Tucker, A. G. Wright, the F. H. Buck Fruit Company of Vacaville; E. A. Gammon, R. J. Coggeshall, and G. B. Greene of Courtland; F. W. Sweet of Martinez; D. Howeroft, the Silva-Bergtholdt Company, the Placer County Mountain Fruit Company, the United Fruit Company, and the California Fruit Exchange of Newcastle.

methods of handling pears for shipment. The equipment and operations herein described are for large orchards, but one who grows pears in a small way may apply the same methods. Some of the best packs of pears, for example, are put out in sheds which have but few modern devices.

HARVESTING

WHEN TO PICK

Unlike most other fruits, the pear develops much better quality when ripened off the tree. The larger varieties (Anjou, Bartlett, Bosc, Comice, Howell) are generally picked when they attain a diameter of from $2\frac{1}{4}$ to $2\frac{1}{2}$ inches or more. Many growers are guided in deciding upon the time of picking by the readiness with which the fruit parts from the spur when it is raised upward; others like to see a little brown on the seeds; still others test by tasting.

The time of picking pears for fresh shipment is determined partly by the size, partly by the condition, and partly by the sugar content. Just how green pears can be when harvested and still ripen satisfactorily must be decided by each grower according to the manner in which the fruit develops in his particular locality. Newcomers should seek this information from the best pear growers in their district. The following table of relative times of ripening in the Sacramento Valley district will aid growers in planning harvesting operations, but it must be kept in mind that there is a great variation in the different districts.

Variety	Time of Ripening
Madeleine	June — July
Comet	June 3 — July 15
Wilder	June 25 — July 10
Clapps Favorite	July
Bartlett	June 25 — Sept. 15
Howell	Aug. — Sept.
Beurre Clairgeau	Aug. 15 — Oct. 1
Beurre Bosc	Sept. 15 — Oct. 15
Kieffer	Sept. — Oct.
Anjou	Oct. 15 — Nov. 15
Winter Nelis	Oct. 15 — Nov. 15
Comice	Oct. 15 — Nov. 15
Glout Morceau	Oct. 15 — Nov. 15
Easter Beurre	Oct. — Mar.

HOW TO PICK

In almost all cases pears for eastern shipment are harvested in several pickings, the largest ones being picked first, leaving the smaller ones on the tree to increase in size. Some growers use picking rings to measure the pears. The larger pears that measure $2\frac{1}{4}$ to $2\frac{1}{2}$ inches will not slip through these rings and are picked, while pears that slip through are left on the tree. Experienced pickers select pears of the proper size, by eye or by measuring with their fingers.

Each pear is carefully picked by hand, by a slight upward turn against the spur, and placed carefully in the picking receptacle, never thrown or dropped. Pickers should be instructed to handle pears as carefully as eggs, for the slightest bruise hastens decay.

PICKING EQUIPMENT

Picking receptacles.—Any type of picking pail, bag, or basket is satisfactory so long as bruising is eliminated and sufficient ventilation provided. The pail should have holes punched in it to allow ventilation. One advantage claimed for the pail is that careless pickers may be readily detected by the sound of the pears when dropped into it. Both pails and baskets are provided with hooks for hanging in the trees or on the ladders. Picking bags are suspended from the shoulders and allow the use of both hands in harvesting.

Ladders.—Most styles of ladders are satisfactory. The three-legged ladder is most commonly used. The ladder should be well constructed of first-class material and light enough for convenient handling. A strand of heavy wire should be tacked on the lower steps of the ladder to prevent wearing by constant climbing.

Lug boxes.—The orchard box, or lug box, into which the fruit is emptied from the picking receptacles, should be of substantial material, wide enough to enable the picking receptacle to be lowered to the bottom for emptying, and preferably with the ends raised above the sides, so that when well filled and piled one above the other there will be no danger of bruising the contents. The ends of the boxes should have grooves to facilitate lifting.

HANDLING THE PICKING CREW

The foreman.—In a large orchard a picking foreman is necessary for the most efficient work. In smaller orchards the owner acts in this capacity. The foreman should have a broad knowledge of the pear

industry—the characteristics of the varieties, time of ripening, and conditions for picking. He should be able to plan ahead and to properly handle men.

Work of the pickers.—The pickers generally work in groups of two. Each pair is told which trees to pick and the size of pears wanted. When the picking receptacles are filled they are emptied into the lug boxes. The receptacle should be lowered as far as possible into the lug box and the fruit carefully rolled out so as to prevent bruising. Many pickers fill the lug boxes too full and the top pears are cut or crushed by other boxes. The filled boxes should be kept stacked in the shade in readiness for the orchard wagon.

Pickers are paid by the hour rather than by the amount of fruit harvested. The owner will get fruit of better quality when the pickers are not rushing to make a day's wage. The pay for pickers during the season of 1921 averaged 30 cents an hour.

HAULING TO THE PACKING HOUSE

The filled lug boxes are gathered promptly and transferred to the packing house with the least possible delay. An easy-riding orchard spring wagon, built low for convenient loading, is used.

PACKING

The packing house.—The types of structures used as packing houses range from temporary sheds to permanent, well-equipped buildings. The size and type of building is governed by the production of the orchard. A well-built frame building providing good light and plenty of ventilation makes an ideal packing house. It should be large enough to accommodate packing tables, graders, nailing presses, and empty boxes, without crowding the packers or obstructing the packing house operations. A wooden floor with extending platforms at the doors is desirable.

Arrangement.—The packing house should be arranged in such a way that the fruit will pass through the various operations of unloading, sorting, sizing, delivering to the packers, packing, nailing, stamping, and loading with the least amount of lost motion (fig. 1). A systematic arrangement of equipment pays well.

EQUIPMENT

Mechanical sizers.—The use of mechanical sizing machines (fig. 1) is extending among pear growers. The rapidity and ease with which pears can be handled with the aid of these machines soon pays for

their purchase. There are several styles of sizers which measure the diameters of the pears, or separate them according to weight, and divert the different sizes into bins or pockets from which they may be packed direct. A satisfactory sizer will accurately separate the various shaped specimens without bruising. (It is believed that weight is the variable that can be most accurately measured.)

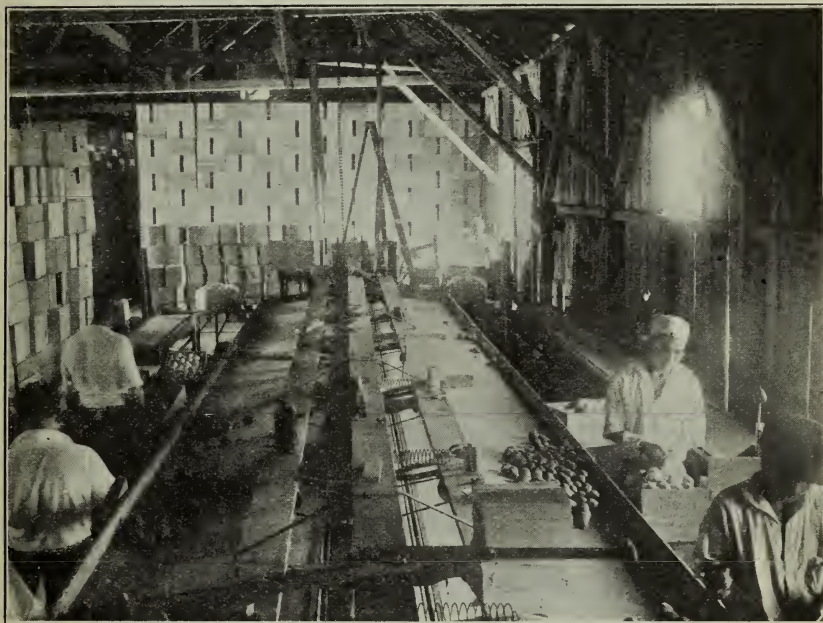


Fig. 1.—Interior of a modern packing house. A mechanical sizing machine with belt conveyors increases the efficiency of packing and handling. The pears enter on two narrow belts which run lengthwise of the packing table. At intervals, smaller belts are fixed at varying heights running transversely to the delivery belts. Pears which on account of their size will not pass under the belts are diverted into the bins.

Packing tables.—There are many designs of packing tables. These are usually fitted with burlap or canvas bottoms, or with wooden bottoms padded with various materials. Any type which prevents bruising is satisfactory. The type to select depends somewhat upon whether or not the pears are sized before delivery to the packing tables. When packing is done direct from a mechanical sizer no additional table is needed, only a stand or platform to hold the pear box (fig. 1). Where pears are not sized before delivery to the packer, a table fitted with a padded bin for receiving the fruit is desirable.

Nailing press.—Properly packed boxes of pears have a high bulge which must be compressed for nailing. A mechanical press which holds the lid down while the nails are driven affords the best means of doing this (fig. 2).

Platform scales.—It is of the utmost importance that each box of pears be of the required minimum weight. A set of accurately tested scales is therefore necessary in every packing house. The scales should be near the nailing press so that the nailer may quickly determine whether to add pears to a box to make up the minimum weight before the lid is applied.

Hand truck.—Many packing houses use one or more hand transfer or “grab” trucks to transfer lug boxes and packed boxes within the packing house and for loading the trucks or cars (fig. 3). This labor-saving device is highly recommended.

Rubber stamps.—The state standardization law³ requires that all containers of fresh pears shall be labeled with the variety and number per box. Use rubber stamps bearing these items, e.g., “Bartlett,” “150.”

Box material.—The standard pear box and the half pear box are the usual containers for shipping pears. Ninety-five per cent of the pears shipped are packed in the standard pear box; the half pear box is used principally in the Vacaville district in shipping early pears. These boxes come in the “knock-down” form commonly termed “shook.” On account of the great pressure, the box material should be of the best quality. The following specifications should be conformed to:

STANDARD PEAR BOX

Ends	two pieces	$\frac{3}{4}" \times 8\frac{1}{2}" \times 11\frac{1}{2}"$
Sides	two pieces	$\frac{3}{8}" \times 8\frac{1}{2}" \times 19\frac{3}{4}"$
Bottom	two pieces	$\frac{1}{4}" \times 5\frac{1}{2}" \times 19\frac{3}{4}"$
Top	two pieces	$\frac{1}{4}" \times 5\frac{1}{2}" \times 20"$
Cleats	four pieces	$\frac{3}{8}" \times \frac{3}{4}" \times 11\frac{1}{2}"$

Use cement-coated 4d special orange-box nails, 28 to the box.

HALF PEAR BOX

Ends	two pieces	$\frac{5}{8}" \times 4\frac{1}{4}" \times 11\frac{3}{4}"$
Sides	two pieces	$\frac{1}{4}" \times 3\frac{3}{4}" \times 19\frac{3}{4}"$
Top	two pieces	$\frac{1}{4}" \times 5\frac{1}{2}" \times 20"$
Bottom	two pieces	$\frac{1}{4}" \times 5\frac{1}{2}" \times 19\frac{3}{4}"$
Cleats	two or four pieces	$\frac{3}{8}" \times \frac{3}{4}" \times 11\frac{1}{2}"$

³ California Fruit and Vegetable Standardization Act, 1921. Growers may obtain copies of this act from the State Department of Agriculture, Sacramento.

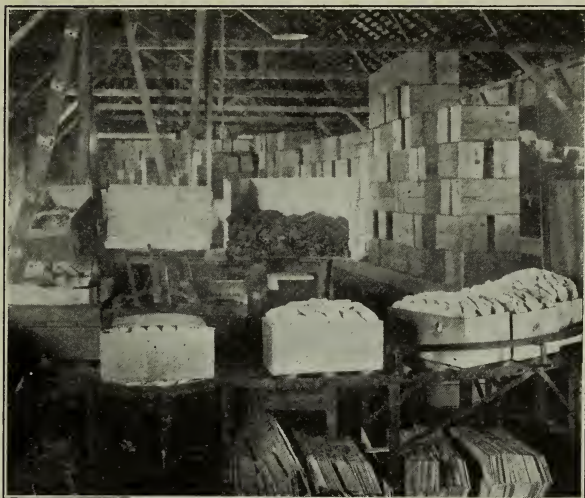


Fig. 2.—An excellent type of nailing press for pear boxes. Note this one is joined by a roller conveyor which delivers the boxes directly to it. Note also the high bulge on the boxes.



Fig. 3.—A desirable type of hand transfer truck. A pair of plow handles attached increases the ease of operation.

Use cement-coated 4d special orange-box nails, 24 to the box.

The half pear box is the standard peach box which comes in three standard sizes, $4\frac{1}{4}$ ", $4\frac{1}{2}$ ", $4\frac{3}{4}$ ", depending upon the height of the ends; other dimensions are identical.

Labels.—The law requires that all containers of fresh fruit shall bear in plain sight and in plain letters the name of the orchard where the fruit was produced, the post-office address thereof, the name of the person, firm, or organization that ships it, and the minimum net weight. These facts are generally printed on a lithographed label which is pasted on the ends of the box by the shipper, or they are sometimes stamped or stenciled on the ends when the shoo is made at the factory. It is well for each grower to use the same design on containers of all fruits that he ships, thus standardizing his brand. The size and shape of the label is reduced or enlarged by the lithographer to fit the ends of the different boxes or crates.

Wrapping paper.—Pears are wrapped individually in paper in the same manner as apples and peaches. The advantages of wrapping are:

1. Checks evaporation, thus reducing loss of weight.
2. Acts as a cushion, preventing bruises both in packing and in shipping.
3. Checks the spread of decay by isolating each specimen.
4. Maintains a more even temperature of the fruit, thus prolonging its period of consumption.
5. Gives a finished appearance to the pack, especially if a small attractive design is printed on each wrapper.

The wrapping paper varies from a coarse tissue paper to a fine waxed paper. It is desirable to get as good a grade as possible with a high tensile strength so that it will not tear in wrapping. The following table indicates the sizes of paper for the various packs:

12" × 12"	for 100 count and larger.
10" × 10"	for 110 to 165.
9" × 9"	for 180 to 193.
8" × 8"	for 210 to 245.
7½" × 8"	{ for smaller
6" × 7"	
	pears.

In ordering wrapping paper figure approximately fifty pounds of paper for every one hundred standard boxes of pears.

Paper needle-hold.—A very handy device for holding the wrapping paper in place for the packer is a small box-like tray fitted with a spring needle to hold the pile in place. As the packer grasps a sheet it easily tears free from the needle leaving the rest of the pile intact.

Finger or thumb-stalls.—Nearly every packer uses a rubber finger cover or thumb-stall. This saves a great deal of time and lost motion in picking up the paper. The best speed is attained by using the finger stall on the middle finger.

PERSONNEL OF THE PACKING HOUSE

Foreman and assistants.—The management of the packing house should be intrusted to a man who understands every detail of packing and preparing the fruit for shipment. He must be a man who can assume responsibility and get maximum results from the packing house crew. He should be assisted by men or women of considerable experience in the various packing house operations. The number of experienced assistants he needs depends upon the size of the crew.

Packers.—In the packing of pears, women and girls often put up a better pack than men, but seldom develop the speed of the most expert. Women and girl packers are preferred to men generally, because greater returns are obtained from fewer neat and attractively packed boxes than from many boxes packed in a hurried and consequently careless and inferior manner.

Packers are paid either by the hour, by the box, or according to a combination of the two methods. The writer believes that the combination plan is the best. By this system packers are paid by the hour up to a certain minimum number of packed boxes; packers who pack more than the minimum are paid more. For example, one grower pays his packers 37½ cents an hour when they pack an average of six boxes an hour; packers who pack more than this number receive a bonus of 5 cents a box. In this instance a mechanical sizer is used and little sorting is necessary. If the fruit is very wormy so that packers must sort a great deal, paying by the day will bring better results than piece work.

Box makers.—Making up the shook may be arranged for by contracting with an expert box maker or by getting some other capable person. Box makers are usually paid by the box rather than by the hour or day. During the 1921 season, box makers received one dollar a hundred boxes. The average number of boxes made ranges between seven and eight hundred for a ten hour day, although some experts make as high as thirteen hundred.

Nailer and inspector.—Usually one man inspects the packed pear boxes and nails on the lids. He must be very capable, and familiar with the requirements of the standardization law, and should return

any packs which are not up to standard. He is the last man to see the pack before it is opened on the market and the final responsibility rests on him.

Helpers.—Other operations in the packing house, such as receiving the fruit, supplying fruit to the sizing machines or to the packers, supplying empty boxes to the packers, transferring the packed boxes to the nailer, removing cull fruit, and loading the trucks or cars are intrusted to floor boys or helpers. These boys must be alert, energetic, and strong enough to perform a day's work in a busy packing house.

OPERATIONS IN THE PACKING HOUSE

Labeling.—Labeling is most conveniently done before the boxes are made. Assuming that lithographed labels are used, they should be removed from their bundles and spread out in water from twelve to thirty hours previous to pasting, in order that the paste may thoroughly penetrate the paper. Labels that are put on dry do not absorb the paste and will curl up and drop off when the paste has dried. Likewise, it is best to have the paste made about twelve hours before application so that it will stick well. It should be made of a creamy consistency and should be thinned or thickened, depending on whether the ends of the boxes are smooth or rough. A convenient device for labeling is a wooden form or slide of such depth and width as to accommodate the end pieces and long enough to contain from thirty to fifty of them. This is constructed as a table raised about three and one-half feet from the floor.

The end pieces are placed side by side in this slide and the paste applied to the entire row with a wide brush. The labels are then taken from the water and carefully placed on the end pieces. The excess paste is washed off with a brush and clean water. The labeled ends are then stacked until dry.

One person labels and stacks on the average about 1500 ends per ten hours. The cost averages about 25 cents a hundred.

Making the boxes.—Either a steel or a wooden frame on a nailing bench is used to hold the end pieces in position while the bottom pieces are fastened. A steel frame is best because it is more durable, does not get out of alignment, and may also be adjusted for other types of boxes and crates.

The box maker places one labeled and one plain end in the frame and nails on the bottom pieces (fig. 4). The corners should be made accurate and square, and the nails should be driven flush with the

surface of the wood and not sunk. Nails whose points stick out of the wood should be removed. The half-finished box is taken from the form and placed on a lower shelf, and the side pieces nailed on.

When the boxes are completed they are stacked by the nailer close by and later removed by floor boys and stored for use.

Receiving and supplying fruit to the packers.—The lug boxes filled with pears are unloaded from the orchard wagon at the packing house door by the driver and the floor boys. They are piled on the platform, keeping the varieties separate where necessary, and later taken inside the packing house by the floor boys.

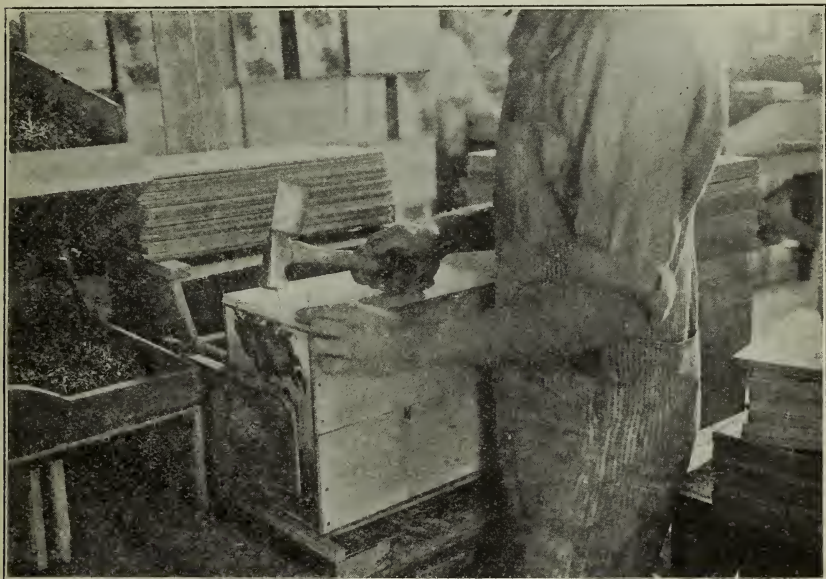


Fig. 4.—Making the pear box. Note the end piece being held in the slot while being nailed.

The fruit is supplied to the packers by several systems varying according to the equipment and its arrangement. Where mechanical sizing machines are used, the pears are rolled out of the lug boxes upon the belt conveyor, which separates the sizes and delivers them to the packers. In other cases, the packers pack directly from the lug boxes and do their own grading and sizing. In still other cases, floor boys carry the lug boxes to the packers' bins, carefully rolling the pears on to the packing table so as to prevent bruising.

Sorting.—Sorting for maturity, color, blemishes, insect injury, and defects of any kind³ must be given consideration before packing.

³ California Fruit and Vegetable Standardization Act, 1921.

This operation must be done by hand. When a sizing machine is used, one or more persons should be stationed at the feeding belt to examine the pears as they move along and pick out fruit not satisfactory for packing. Finally, it remains for the packer to see that the fruit which he places in the box has been properly sorted. According to law, the number of pears showing defects must not exceed 10 per cent in any one box.

Sizing.—After being sorted, the pears are separated into the different sizes. A mechanical sizing machine does this automatically. In some packing houses men or women are specially detailed to divide the pears into different sizes before they are delivered to the packers. Where no provisions are made for sizing, however, the packers themselves are responsible for selecting the sizes for the different packs. In order to comply with the state standardization laws pears in the same box should not vary more than one-half inch in diameter.

Packing the box.—Pears may be packed directly from the lug box into two or three pear boxes, if the fruit is not uniform in size, or, if it is uniform, into one box. They may also be poured into the bins of the packing table and packed one box at a time, packing first one size and then another. When the fruit has been sized, however, each packer packs only one size. The empty box is placed on the packing platform or stand. The packer selects a pear and starts to wrap (fig. 5a). He picks up a pear of the proper size with the right hand and examines it for insect injury or other blemishes. At the same time he picks up a sheet of wrapping paper with his left hand. In picking up the wrapping paper care should be taken to grasp it toward one corner to allow more paper to be finally folded over the pear (fig. 5b). The pear is thrown from the right hand into the paper held in the palm of the left hand with the stem up, resting between the thumb and forefinger (fig. 5c). A little force is necessary to break down the paper and bring the corners into position for wrapping with the least amount of lost motion. The corners of the paper are then folded over the apex end of the pear and the pear is turned up with the right hand while the left hand and fingers twist the paper around the stem of the fruit in such a way that a point or cornucopia is formed (fig. 5d). The pear is next placed in the box with the left hand, the stem pointing toward the packer (fig. 5e) (except the first row across the end of the box in which the stem points in the opposite direction). While the wrapped pear is being placed in the box with the left hand, the right hand is reaching for another.

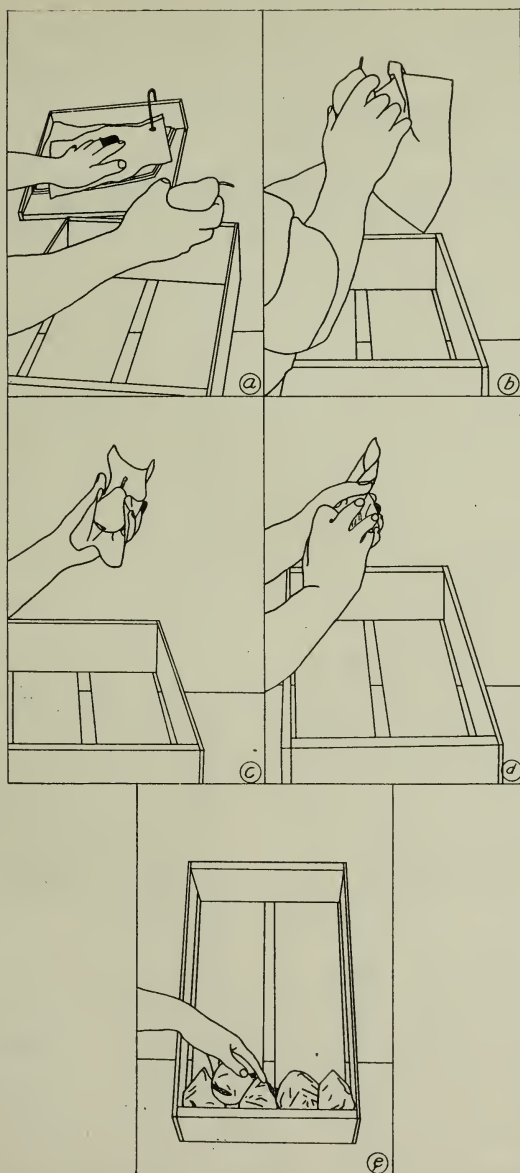
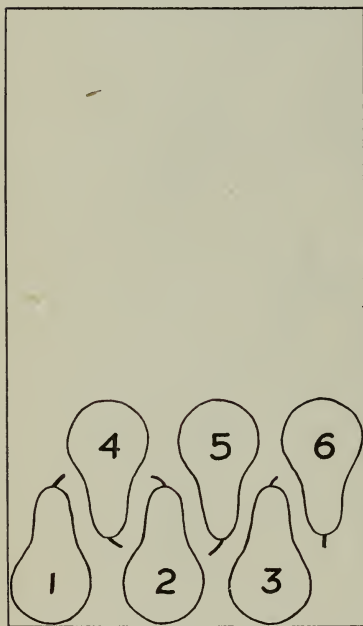


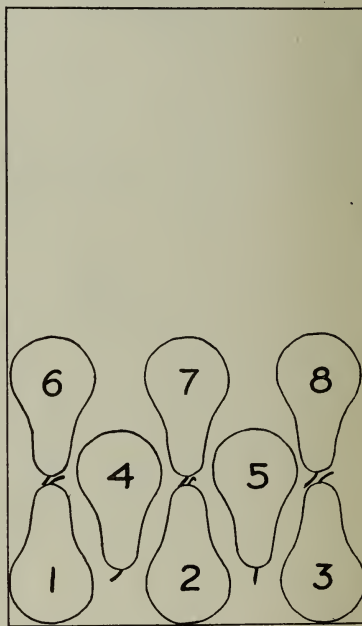
Fig. 5.—Progressive steps in wrapping pears.

The question may arise as to the additional time required in wrapping each fruit. As a matter of fact, packing can be done much faster with wrapping than without. The actual time of wrapping is but a fraction of the total time involved in the operation of packing. If packed without wrapping the pears will often not remain in place well, while if wrapped they "stay put."

STYLES OF PEAR PACKS



"3X3" OFFSET



"3X2" DIAGONAL

Fig. 6.—Styles of pear packs.

Styles of pack.—There are two styles of packs, the "offset" and the "diagonal." The "offset" pack (3×3) is employed for pears which by reason of their size will go five or more across the box. For pears larger than this the "diagonal" pack (3×2) should be used.

1. "Offset" (3×3) style. The first pear is placed in the left-hand corner of the box, the next two are so placed that the space between the first and second and the second and third will be the same as that between the lower right-hand corner and the third pear. This row is placed with the stem pointing away from the packer. The next row is placed with the stems toward the packer, the pears nesting in the spaces formed by the first three pears (fig. 6). This is continued throughout the first layer with the stems pointing toward the

packer, care being taken that the alignment is kept perfect. In starting the second layer packing should begin in the opposite corner of the box and the pears placed directly over the spaces formed by the fruits in the first layer.

2. "Diagonal" (3×2) style. This pack is similar to the "offset" style, except that it is started by placing one pear in each corner of the box and a third pear midway between them. The next row is placed in the spaces formed by these three (fig. 6). The pack is continued as described above for the "offset" style.

One important consideration is securing a proper bulge (fig. 2) to the completed pack. This is learned with a little practice. The building of the bulge should commence with the first layer. In the middle of each layer the fruit should be slightly larger or should have the stems pointing at a little steeper angle upward than the pears in the end. This is continued throughout the box so that when the top is reached there is a bulge of from $1\frac{1}{2}$ to 3 inches at the center of the box above the fruit at the ends, which is level.

This bulge is necessary to secure a solid pack. Pears will shrink considerably in transit and if packed loose will soon be disarranged and shake around in the box, which results in bruising and rapid decay.

The packed box must be marked with the total number of pears contained. This number can readily be determined by using the following table for reference. By counting the number of pears across the box, and the number lengthwise in two consecutive rows, the total number of pears can be found in the table.

PEAR PACKS

Width	Length	Layers	Total per box
4×3	7×7	5	245
4×3	7×6	5	228
4×3	6×6	5	210
4×3	6×5	5	193
3×3	6×6	5	180
3×3	6×5	5	165
3×3	5×5	5	150
3×3	5×4	5	135
3×3	4×4	5	120
3×3	6×5	4	110
3×2	5×5	4	100
3×2	5×4	4	90
3×2	4×4	4	80
3×2	4×3	4	70
3×2	3×3	4	60

When pears are packed in the half pear box the number may be calculated in a similar manner.

Fruit from the packers.—When the packer has finished packing the box, it is marked with the number of pears, variety, and the packer's number or letter. The box is transferred to the nailing press either by a belt conveyor (fig. 7) or by floor boys, or sometimes by the nailer.

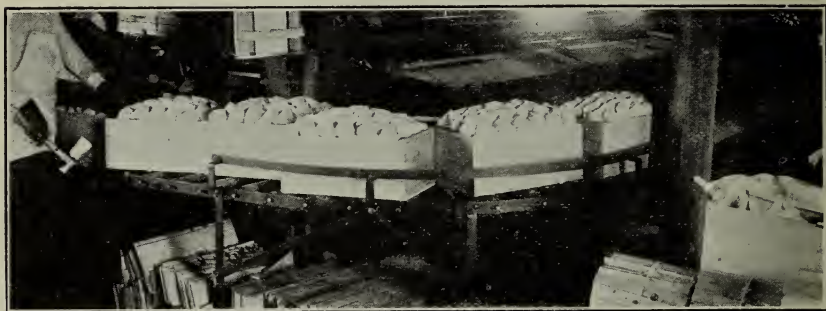


Fig. 7.—A belt or roller conveyor is an aid in carrying packed boxes to the nailing press.

Inspection and nailing.—The nailer also acts as inspector, examines the completed packs, verifies the number that has been placed upon the box by the packer, observes the weight, tightness of the pack, bulge, and general fitness of the box for shipment. If a box is not satisfactory in all details it must be corrected, either by the nailer or the packer. Boxes that are satisfactory are placed in the nailing press. Pears projecting over the sides are pushed in so that they will not be cut when the lid is applied. The top pieces and cleats are laid on and the lid pressed down for nailing. Four 5d cement-coated nails are driven through each end. The pressure is then relieved and the box removed from the press. For export shipping the ends are bound and nailed with box strapping.

Stamping and stacking.—Stamping of the number and variety is usually done by the nailer. The boxes are then stacked about five high, placing the boxes on their sides and not on the bulge. For convenience in counting and loading, boxes of the same variety and the same numerical count should be placed in a pile.

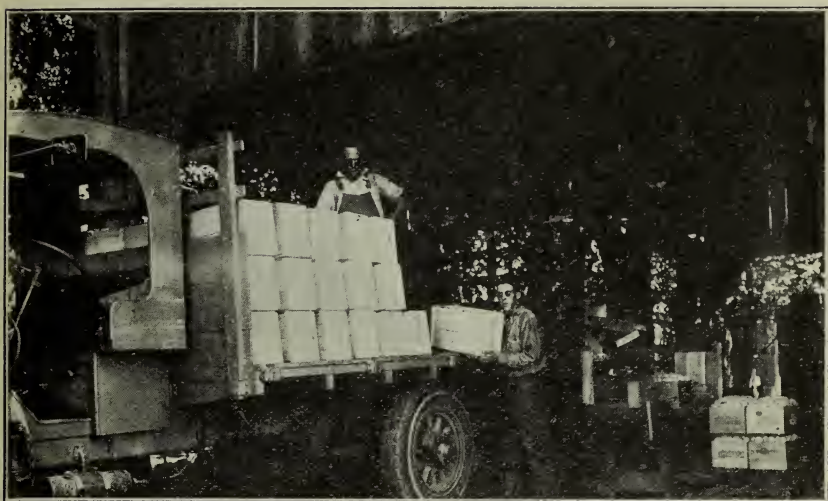


Fig. 8.—Loading packed boxes on an automobile truck. A desirable feature of this truck is that it may be loaded from the side.

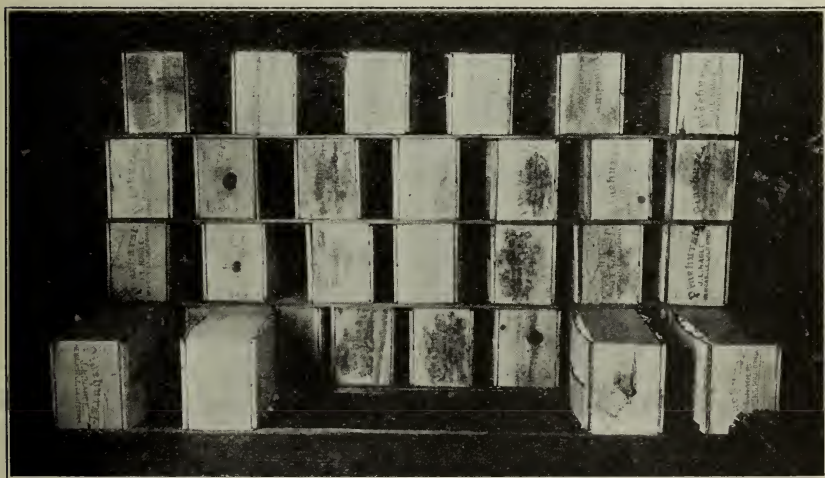


Fig. 9.—Interior of a refrigerator car showing method of loading and "striping" the pear boxes.

LOADING FOR SHIPMENT

Delivery to the car.—Packed boxes are delivered to the refrigerator cars by wagon or automobile truck (fig. 8). The conveyance should be easy riding to prevent bruising of the fruit. The load should be covered with a light canvas to protect from the sun and dust. In some districts pears are shipped by boat. This involves extra handling and many growers feel that even though the cost may be greater, hauling by automobile truck is preferable. If there is a railroad siding at the packing house, the packed boxes are transferred direct to the car by means of hand transfer trucks (fig. 3). Other means of transfer is by low platform trucks which may be wheeled directly into the car.

The latest device, however, for loading the car from the packing house is the gravity conveyor which permits transfer of boxes into the car on roller bearing tracks.

Loading the cars.—Railroad tariff regulations allow twenty-six thousand pounds as a minimum load for a car of fresh fruit from California to Eastern points. Pear boxes are estimated and billed at fifty pounds gross; therefore, it requires exactly five hundred and twenty boxes for a minimum car load. The boxes are held in place by car strips (fig. 9). Following is the arrangement of boxes inside the car:

4 tiers 8 wide, 4 high, 32 boxes per tier, 128 boxes, 50 lbs.,	6,400 lbs.
14 tiers 7 wide, 4 high, 28 boxes per tier, 392 boxes, 50 lbs.,	19,600 lbs.
18 tiers	520 boxes 26,000 lbs.

Detailed directions for loading are supplied by railroad authorities.

THE LABOR PROBLEM

The labor situation is very important. Keeping the help satisfied, so that a steady reliable crew will be at work is a problem that calls for careful thought and planning. The grower who best provides for the needs and comfort of his workers is the one least likely to have a restless, changing crew.

Growers who employ a large crew during the harvest season must provide quarters and other accommodations for their help. Some growers supply a camping ground, with tents or cabins, beds, stoves, fuel, bathing or shower conveniences, and a mess house. The writer has in mind one grower who provides small furnished apartments for

his packers (who are girls and women). Some fruit workers prefer to cook their own meals, while others prefer to board at the ranch. In either case the grower must make the necessary arrangements.

COST OF MATERIALS AND OPERATION

The following figures give the average cost of handling pears in the Silva-Bergtholdt Orchards at Newcastle in 1921:⁴

Cost of production on trees per box	\$.655
Box and label200
Paper, best quality, printed085
Making boxes, and nails015
Picking270
Packing and lidding110
Hauling040
Loading and bracing050
Total	<hr/> \$1.425

⁴ R. E. Hodges, "Production of Fruit Requires Capital," Pacific Rural Press, Vol. CII, No. 5, p. 103.

BULLETINS

- No.
 185. Report of Progress in Cereal Investigations.
 241. Vine Pruning in California, Part I.
 246. Vine Pruning in California, Part II.
 251. Utilization of the Nitrogen and Organic Matter in Septic and Imhoff Tank Sludges.
 253. Irrigation and Soil Conditions in the Sierra Nevada Foothills, California.
 261. Melaxuma of the Walnut, "Juglans regia."
 262. Citrus Diseases of Florida and Cuba Compared with Those of California.
 263. Size Grades for Ripe Olives.
 266. A Spotting of Citrus Fruits Due to the Action of Oil Liberated from the Rind.
 267. Experiments with Stocks for Citrus.
 268. Growing and Grafting Olive Seedlings.
 270. A Comparison of Annual Cropping, Biennial Cropping, and Green Manures on the Yield of Wheat.
 271. Feeding Dairy Calves in California.
 273. Preliminary Report on Kearney Vineyard Experimental Drain.
 275. The Cultivation of Belladonna in California.
 276. The Pomegranate.
 278. Grain Sorghums.
 279. Irrigation of Rice in California.
 280. Irrigation of Alfalfa in the Sacramento Valley.
 282. Trials with California Silage Crops for Dairy Cows.
 283. The Olive Insects of California.
 285. The Milk Goat in California.
 286. Commercial Fertilizers.
 287. Vinegar from Waste Fruits.
 294. Bean Culture in California.
 297. The Almond in California.
 298. Seedless Raisin Grapes.
 299. The Use of Lumber on California Farms.
 300. Commercial Fertilizers.
 304. A Study on the Effects of Freezes on Citrus in California.
- No.
 308. I. Fumigation with Liquid Hydrocyanic Acid. II. Physical and Chemical Properties of Liquid Hydrocyanic Acid.
 309. I. The Carob in California. II. Nutritive Value of the Carob Bean.
 310. Plum Pollination.
 312. Mariout Barley.
 313. Pruning Young Deciduous Fruit Trees.
 316. The Kaki or Oriental Persimmon.
 317. Selections of Stocks in Citrus Propagation.
 318. The Effects of Alkali on Citrus Trees.
 320. Control of the Coyote in California.
 321. Commercial Production of Grape Syrup.
 323. Heavy vs. Light Grain Feeding for Dairy Cows.
 324. Storage of Perishable Fruit at Freezing Temperatures.
 325. Rice Irrigation Measurements and Experiments in Sacramento Valley, 1914-1919.
 328. Prune Growing in California.
 329. A White Fir Volume Table.
 330. Dehydration of Fruits.
 331. Phylloxera-Resistant Stocks.
 332. Walnut Culture in California.
 333. Some Factors Affecting the Quality of Ripe Olives.
 334. Preliminary Volume Tables for Second-Growth Redwoods.
 335. Coconut Meal as a Feed for Dairy Cows and Other Livestock.
 336. The Preparation of Nicotine Dust as an Insecticide.
 337. Some Factors of Dehydrator Efficiency.
 338. Selection and Treatment of Waters for Spraying Purposes.
 339. The Relative Cost of Making Logs from Small and Large Timber.
 340. Control of the Pocket Gopher in California.
 341. Studies on Irrigation of Citrus Groves.
 342. Hog Feeding Experiments.

CIRCULARS

- No.
 70. Observations on the Status of Corn Growing in California.
 82. The Common Ground Squirrels of California.
 87. Alfalfa.
 110. Green Manuring in California.
 111. The Use of Lime and Gypsum on California Soils.
 113. Correspondence Courses in Agriculture.
 115. Grafting Vinifera Vineyards.
 126. Spraying for the Grape Leaf Hopper.
 127. House Fumigation.
 128. Insecticide Formulas.
 129. The Control of Citrus Insects.
 130. Cabbage Growing in California.
 138. The Silo in California Agriculture.
 144. Oidium or Powdery Mildew of the Vine.
 148. "Lungworms."
 151. Feeding and Management of Hogs.
 152. Some Observations on the Bulk Handling of Grain in California.
 153. Announcement of the California State Dairy Cow Competition, 1916-18.
 154. Irrigation Practice in Growing Small Fruits in California.
 155. Bovine Tuberculosis.
 157. Control of the Pear Scab.
 158. Home and Farm Canning.
 159. Agriculture in the Imperial Valley.
- No.
 160. Lettuce Growing in California.
 161. Potatoes in California.
 164. Small Fruit Culture in California.
 165. Fundamentals of Sugar Beet Culture under California Conditions.
 166. The County Farm Bureau.
 167. Feeding Stuffs of Minor Importance.
 169. The 1918 Grain Crop.
 170. Fertilizing California Soils for the 1918 Crop.
 172. Wheat Culture.
 173. The Construction of the Wood-Hoop Silo.
 174. Farm Drainage Methods.
 175. Progress Report on the Marketing and Distribution of Milk.
 178. The Packing of Apples in California.
 179. Factors of Importance in Producing Milk of Low Bacterial Count.
 181. Control of the California Ground Squirrel.
 182. Extending the Area of Irrigated Wheat in California for 1918.
 183. Infectious Abortion in Cows.
 184. A Flock of Sheep on the Farm.
 188. Lambing Sheds.
 189. Winter Forage Crops.
 190. Agriculture Clubs in California.
 193. A Study of Farm Labor in California.
 198. Syrup from Sweet Sorghum.
 201. Helpful Hints to Hog Raisers.